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Poultry Diseases

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Bureau of Animal Industry

Healthy fowls raised under natural conditions and free from disease at the Pennsylvania Bureau of Animal Industry farm, Harrisburg.

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Poultry Diseases

By E. L. Stubbs, V. M. D.

Bureau of Animal Industry

Poultry diseases present a problem of great importance to all those interested in poultry. Most Pennsylvania farms raise poultry. Our population consumes large quantities of poultry and poultry products. Poultry diseases therefore have an effect directly or indirectly on producer and consumer alike, which includes all our people.

Our farm hen is found in greater numbers each year on most all Pennsylvania farms and is a universal source of farm income. Commercial poultry farms are increasing in number.

It was estimated that on January 1, 1927, there were present on Pennsylvania farms 18,716,000 chickens valued at $23,957,000. This number represented an increase of 900,000 chickens during the preceding year. Lancaster County is the largest poultry county in Pennsylvania, having hens and pullets on 99 per cent of its farms.

Disease is Greatest Poultry Menace

Disease is the greatest menace to this great Pennsylvania industry. The disease menace is all the greater because of the rapid increase in numbers. The increased number of fowls is frequently kept on the same area and very often with the same equipment as was formerly used for a smaller number. This expansion has remained profitable perhaps even more so than any other farm livestock operation. When such an operation continues to be profitable, every effort is made to increase production. This has been particularly true in poultry keeping and all possible means have been used to raise production to the highest possible peak. Intensive methods of feeding have been used together with intensive methods of breeding. All these things have tended to create a more artificial environment with a consequent increased susceptibility to disease. The fact alone that fowls are kept in increasing numbers under more crowded conditions with greater contact, is sufficient to increase the prevalence of diseases.

Disease is the successful invasion of the tissues by a disease process. Many diseases are due to organisms, germs or microbes too small to see.

Thus when harmful organisms gain entrance into the flock or into individuals in the flock, there begins a contest. If the bird is in robust condition the body cells of the bird may overcome the organisms and win the contest. In other cases the organisms multiply and cause sickness or death.

Thus disease is largely a contest between the invading organisms, germs or microbes on the one hand and the tissues of the fowl with all their resources on the other. If the organisms win, then disease occurs, if the tissues of the fowl are superior the fowl remains healthy.

Most Common Diseases Described

This bulletin describes the diseases which are most common in Pennsylvania fowls. It is based on the work done in connection with the Division of Laboratories of the Pennsylvania Bureau of Animal Industry.

The Pennsylvania Bureau of Animal Industry maintains a Laboratory in which a study is made of transmissible poultry diseases as well as other transmissible livestock diseases. Specimens of diseased poultry are received from practicing veterinarians all over Pennsylvania. Many field investigations are also made in co-operation with the local practicing veterinarians where poultry diseases are occurring. The Bureau also maintains an experimental farm for research in transmissible animal and poultry diseases. The Pennsylvania Bureau of Animal Industry serves the poultry industry in this way.

Consult Your Veterinarian

No attempt has been made in this bulletin to describe methods of diagnosis or to give specific treatment. The results obtained in poultry disease work depend on accurate diagnosis. Accuracy in diagnosis and proper treatment depends on a training in the fundamental medical sciences.

Veterinarians are trained in the fundamental medical sciences as applied to animals and poultry and are the persons best qualified to diagnose and treat poultry ailments. Proper treatment and handling the flock depends on the conditions under which the disease is occurring.

Poultry keepers who are experiencing trouble with disease in poultry should consult their veterinarian who is trained in handling animal and poultry diseases.

HYGIENE AND SANITATION

Hygiene may be termed the science of the preservation of health or a set of rules and regulations for maintaining health. This implies health as a necessary condition in starting a plan of hygiene. Thus health becomes a fundamental requisite for successful poultry raising and is a matter of first importance. Without health, hygiene is of much less importance.

The most rigid rules and regulations are of little value unless first there is healthy livestock on which to use such rules. No aid is of any greater value than hygiene in promoting healthful livestock. This is especially important in the problem of preventing disease but is also one of the most important aids in rendering service to flocks in distress from disease. A careful consideration of hygiene is a great aid in the successful treatment of any kind of livestock but is especially important and of great value in poultry diseases. Poultry are perhaps more susceptible to errors in hygiene than any other kind of livestock.

Water. Water is one of the requirements of all kinds of livestock. An ample supply of fresh pure water is a necessary requirement for poultry as well as all other kinds of livestock. Such a supply of water should be kept before the birds at all times as a preservation of health, likewise in attacks of disease. Water comes from supplies which may be considered shallow, deep and artesian. The source of the supply is not so important as the purity of it. Impurities found in water are of two kinds, inorganic and organic. The inorganic impurities are the salts and metals which may gain entrance by various ways. Pickle or brine is very dangerous to let chickens have access to. Inorganic impurities also may gain access to the water in various ways not only at the source of supply but many other places.

Organic matter is the more important impurity so far as poultry is concerned. These impurities may be animal or vegetable substances. Such substances may serve to make water sterile or may be a definite disease producing agency. This is especially true where bacterial contamination occurs. Certain diseases are said to be waterborne that is such diseases may be carried by water or the water may serve as a medium for the propagation of bacteria with disease producing power. Water offtimes becomes polluted with various things. For instance a bird may die of fowl cholera and may be thrown into a stream or drainage may carry the organisms into the water supply. Affected birds may contaminate drinking water receptacles which may serve as means of communicating diseases from one bird to others. Puddles of water may serve as breeding places for disease.

Water is also favorable for the sporulation of oocysts the cause of coccidiosis and for the embryonation of all kinds of parasite eggs. Earnest efforts should be made by everyone to keep water receptacles clean and fresh in order to supply a healthful source of water for fowls. Chickens will usually drink more water which is cold than hot, so cold water should be available. In winter the only precaution necessary is to prevent freezing in cold weather.

Air. Pure air is a necessary requirement of all livestock. It is especially necessary in poultry. Fowls have a complicated respiratory tract and need large quantities of fresh air. In addition to the lungs birds have air sacs or spaces in the abdominal cavity and in the bones. These are in communication with the lungs but there is no process to facilitate the movement of the air. For this reason plenty of good fresh air is desirable.

Chickens need air from the very beginning of life. Eggs must have air in order for the embryo to remain alive and to develop. Fresh air is also necessary during all stages of incubation and brooding as well as throughout life. Birds like other animals can do without food and also water for a time but without air only a short time. Impure air has a quick effect on the health. The object of ventilation of course is to supply unlimited quantities of fresh air. Three factors must be considered—

1. The amount of fresh air required.
2. The method by which fresh air can be supplied.
3. The method of examining to determine whether ventilation is proper.

Fresh air may be supplied by diffusion and by the action of winds. Birds however are very susceptible to drafts and the process of diffusion is the best method. This process is slow and ample intake should be provided. The only accurate method of determining whether the air in a poultry house is pure is by measuring the amount of carbon dioxide. This can be judged very readily by the sense of smell and comparison of the outside air with the inside air.

Sanitation is the science pertaining to sanitary conditions. Where large numbers of birds are brought together especially on a limited area conditions become unsanitary and disease threatens. Other things being equal the greater the number of birds kept on a given area the greater the danger of disease and the sooner it will appear. Sanitation includes the measures taken to prevent or delay the appearance of disease in a flock, or the measures taken to limit its spread and eradicate a disease which has appeared. Diseases are occurring in proportion to the concentration of increased numbers of fowls kept in poultry flocks.

The problems of sanitation are made easier by the selection of suitable ground with proper drainage on which to keep chickens. The ground surface should be smooth so that drainage and water does not accumulate in pools. Open, porous sandy soil with a gravelly subsoil is best. Heavy shale or clay soils should be avoided because such soils are wet and cold. A wet soil favors parasites and too much dampness is not good for fowls. The soil is of particular interest because on it are deposited the body wastes which may contain disease producing organisms as well as parasites and parasite eggs. Large numbers of fowls inhabiting small areas of soil highly contaminate that soil and disease becomes more or less permanently established. When soil is cultivated or left unpopulated for a time, it has a chance to rid itself of harmful materials, while when there is continued concentration of large numbers of fowls on a comparatively small area of soil, the soil becomes sour with sewage and body wastes. Yard rotation with cultivation has a very important place in poultry production.

Fig. 1. Healthy fowls raised in clean quarters on clean ground at the Pennsylvania Bureau of Animal Industry farm, Harrisburg.

Shade should also be provided for the excessive heat of summer.

The housing is important for proper regard to the health of fowls. Poultry houses should be constructed so that they can be easily cleaned and properly disinfected periodically and whenever necessary. Anything that will interfere with the free access of a man to any part of the house should be avoided as this will interfere with the cleaning. The habit displayed by mites and lice should be remembered and a minimum of such places provided where vermin may collect. Nest boxes, perches and other similar fittings should be simply constructed and not permanently attached so that they may be removed for disinfection. Certain details of construction will at least serve as impediments to the propagation and dissemination of parasites and disease producing organisms. Wire should be placed beneath the roosts as this will largely prevent the birds coming in contact with their own droppings and thus will help limit the spread of parasites and disease.

Sunlight. The houses should be light. Sunlight should penetrate to all parts of the house as much as possible. It is a purifier as well as a germ destroyer, and also adds warmth, making surroundings more congenial and acting as a tonic. The openings should be so placed as to permit the most sunlight to enter the house especially in winter and if possible the entire floor should be exposed to the direct rays of the sun at sometime each day.

Proper ventilation must be supplied because as previously explained the respiratory apparatus of birds is quite complicated requiring an abundance of fresh air. The bird has no sweat glands and many impurities are gotten rid of by inhalation. Houses, however, must be constructed so that there will be no drafts, because drafts make fowls susceptible to disease.

Houses must be kept dry. Too much moisture or dampness is unhealthful. Three kinds of moisture must be considered. Atmospheric moisture and moisture of condensation can be controlled by proper ventilation. Soil moisture can be controlled by a proper kind of floor.

The houses must be roomy because overcrowding is one of the greatest factors in the propagation and dissemination of disease. Houses should also be constructed rat-proof not only because rodents are a nuisance but because such animals may spread disease and they may in certain cases contract disease and spread it by contact. Houses can be constructed economically but should not be constructed too cheaply to be good.

The feeding of poultry has become an exact science. A successful poultry keeper safeguards his feeding problem by feeding certain basic food materials. Fowls will not grow normally on a diet of whole grains alone as corn, wheat and oats. These foods are perfectly wholesome and good but are insufficient to satisfy all the body requirements for good production. Such foods lack certain protective substances known as vitamins. Available sources of these substances for poultry are milk, green leafy plants and yolk of eggs. Milk, tender leaves and egg yolks in the poultry diet will insure vigorous, healthy well grown pullets which will develop their inherited traits and become profitable, productive adults.

Range should be fairly large, well drained and fertile enough to insure luxuriant green growth. Range kept in permanent grass has a distinct value. There is nothing better than legumes. A well seeded alfalfa sod will furnish adequate green food.

INFECTIOUS DISEASES OF POULTRY

Infectious diseases present a serious problem to the poultry industry. The fact that fowls are kept in greater concentration than any other farm animal, and the fact that the poultry industry is increasing in numbers faster than any other farm livestock, greatly increases the danger of outbreaks of infectious diseases. Such conditions make the losses from disease so much greater. Fowls are susceptible to infectious diseases and when attacks occur the flocks are decimated rapidly. The ravages from infectious diseases are enormous.

Few subjects are of greater importance to the American citizen than the losses occurring to our livestock from infectious diseases. An enormous amount of money is invested in the domestic animals of our country. Agriculture represents the largest investment of any group of American capital. Successful agriculture is more or less dependent on the successful raising of livestock. The security of this huge investment in livestock depends very largely on the protection of this livestock against the invasion from the infectious diseases.

Furthermore the livestock industry produces a large amount of the food for our people as well as clothing and other necessities of modern civilization. It is a narrow and incorrect view to hold that the owner of animals is the only one who suffers from the ravages of livestock diseases. If this food supply is diminished or the fertility of the soil damaged, want, misery, disease and death among mankind increases.

Poultry represents the largest numbers of our domesticated livestock. Thus anyone who has the conservation of poultry at heart assumes an important place in the makeup of our nation.

The development of the science of bacteriology and the knowledge regarding parasitic protozoa, has demonstrated that the infectious diseases are the direct invasion of the animal body by micro-organisms. A specific cause is recognized as being responsible for outbreaks of infectious diseases among poultry. In many of these diseases the specific agent has been found while in others it is as yet undiscovered.

In a consideration of infectious diseases this idea of a definite and specific cause must be kept in mind. It is no longer justifiable to attribute such diseases to unfavorable environment, poor hygiene or improper sanitation. These things may aid very greatly the specific cause, but cannot supplant it. It is sometimes difficult and troublesome to differentiate between the morbid affections, often fatal in their results, brought about by improper care and food, and the maladies dependent upon specific cause. It is important therefore that the limitations of both the exciting cause and the environment should be fully taken into account. Conditions have been encountered in flocks which were highly fatal and which resembled infectious disease, that were not due to specific cause but were present, because all the members of the flock were subjected to the same conditions. It is here that veterinarians can be of very great service to the poultry industry. Veterinarians by training and experience are familiar with disease and disease processes.

Chickens develop very rapidly. The period of incubation of eggs is only three weeks, which represents the period of gestation in mammals; growth is very rapid with early maturity. The poultry industry has been subjected to forced methods. This has increased the susceptibility to diseases especially the infectious diseases.

The term infection has become to be understood to mean the entrance into the animal body of micro-organisms, which have the power of multiplying and producing local or general diseased conditions. These invading organisms may belong to any of the three great groups, namely, bacteria, higher fungi and protozoa.

Where the invading bacteria multiply rapidly and become widely distributed in the body the condition is termed septicemia or bacteremia. A typical example of this is fowl cholera.

When the invading bacteria do not become so widely distributed, but elaborate a poison which is absorbed, the condition is termed toxemia. Botulism is a typical example of such a disease in fowls.

Where the invading organism is possessed of definite pathogenic properties, producing a definite series of symptoms and lesions the affection is called a specific infectious disease.

Fowls become infected with these diseases in various ways. The more common ones are those by which other livestock become infected.—

1. By way of the digestive tract. The bacteria are carried in by the food and drink to find entrance or lodgment in the tissues adjacent to the intestine. It is not clear in all cases how the invading organisms gain entrance into the tissues.

2. By way of the respiratory tract. The respiratory tract of fowls is quite susceptible to infection. This is especially true in the upper respiratory tract and may account for the very prevalent troubles of the air passages in the head.

3. By way of the skin and mucous membranes. The wide distribution of organisms makes it highly probable that many diseases enter by way of the skin and mucous membranes.

A specific infectious disease is the result of the multiplication within the animal body of a single species of microorganisms. The changes produced by such a germ may be local or general. Thus fowl cholera due to the bi-polar organism *Pastuerella avicida* is caused by the multiplication of this single species of microorganism within the fowl's body, producing a generalized disease. The course of such a disease varies in different individuals and in different flocks. It is believed this disease is introduced by way of the digestive tract.

It is of course important not to mistake for an infection some other form of body disturbance to which the fowl is heir. Fowls suffer as do other forms of livestock from the conditions of life under which they live.

It often happens that all the fowls in a given flock are subjected to like conditions, and a number of them, perhaps all may show similar sypmtoms and many die. Such a condition often gives rise to the supposition that the cause of death is some form of infection. Deaths from such causes or under such conditions should be differentiated from the infectious diseases.

An infectious disease caused by a specific agent implies an exposure and an infection. Exposure to disease is followed by a period of incubation which is the time from the entrance of the infection until the symptoms appear. This time depends on how long it takes for the organisms to become established in the body to bring about the first symptoms. This period varies in different diseases and also more or less in the same disease dependent on several factors. The mode of infection, the virulence of the organism and the resistance of the individual are factors.

The morbid changes produced by an infectious disease are more or less similar especially when animals are infected at about the same time. It also happens that frequently the course of the disease is changed so that an acute case appears to recover but really becomes chronic or sub-chronic in nature, terminating in some other condition and death. The lateness of such a course and the modified changes produced ofttimes causes such a disease to go unrecognized. This is especially true in diseases like bacillary white diarrhoea, coccidiosis and fowl cholera. Chicks which do not die from bacillary white diarrhoea may do well for awhile only to develop a chronic trouble and never are thrifty. Quite often fowl troubles can be traced back to an attack of a disease such as bacillary white diarrhoea. The same thing is true of coccidiosis. This condition shows all the characteristics of an acute infectious disease in young chicks. The mortality in such a flock may cease abruptly, and the flock recover temporarily only to be attacked later with an obscure condition of deranged nutrition or other disease.

The final test in arriving at a diagnosis of an infectious disease is finding the specific organism or providing the transmissibility from sick or dead fowls to healthy fowls.

Consideration of the infectious diseases of fowls must include the various ways by which such diseases are disseminated. The general ways and means by which the causative factors are spread from an infected individual fowl to a non-infected one in the same flock or to another flock are important. Each organism or virus is dependent for its perpetuation upon its escape from one bird (sick or dead) to another. Such causative factors are without power of locomotion or migration and are dependent on other forces and carriers for their transference.

The transmission of disease organisms from a sick fowl directly to another fowl is believed to be by far the most potent factor in the spread of disease. Thus the greatest factor in the eradication of disease is the destruction of disease organisms which are present in the greatest numbers in the diseased fowls.

The disease organisms are quite frequently introduced into a flock by the addition of a fowl or number of fowls. This may be in the form of acute and active cases or chronic cases. It is for this reason that fowls to be added to a flock and have been purchased or have passed through shipping centers or exposed to disease in any way, should be isolated for a period of time in order that every precaution may be taken against introducing disease. Even such a procedure is of no avail in a disease like bacillary white diarrhoea, because in addition to the above precautions a blood test should be made in order to not introduce this disease. The fowl to all appearances may be all right and even after a period of quarantine may still be capable of transmitting this disease.

BACILLARY WHITE DIARRHOEA

Bacillary white diarrhoea is a very fatal disease of baby chicks and causes enormous losses to the baby chick industry as well as to the health of poultry in general. This disease is most conspicuous in baby chicks but the same cause is responsible for disease in adult chickens where it may cause losses by deaths. In adult hens however this infection is usually confined to the ovary producing a condition that is known as a carrier.

Infection may occur in several ways. The most common source is through infected eggs laid by infected adults. There is a direct connection between the occurrence of the disease in infected chicks and in mature fowls. There exists a definite cycle by which the infection is kept alive and transmitted. When an outbreak of bacillary white diarrhoea occurs in chicks, all the chicks do not die. Some apparently recover and these usually retain the infection in their ovaries throughout life. Adult fowls may also contract this chronic form or so-called carrier form. Eggs thus produced by carriers may contain the infection in the yolk. Such eggs when used for hatching directly infect the baby chicks and the disease is produced.

Spread of Disease

Infected chicks may spread the disease throughout the flock. Chicks may also become infected from contaminated premises as incubators, brooders and coops. The greatest number of outbreaks however is traced directly to infected eggs used for hatching. There is this well-defined cycle of the germ passing from the infected ovary of the hen to the egg, to the chick and to the hen.

Young chicks are very susceptible. Chicks infected when hatched or when infected during the first few days of life, have very little resistance and usually die. Death occurs soon, losses starting a few days after hatching. Losses may continue for several weeks and chicks which survive may be stunted and unthrifty.

Attempts at treatment are useless. When the disease is noticed large numbers of organisms are already distributed throughout the chick's body. All affected chicks should be destroyed and cleanliness with disinfection practiced. Individuals which recover are dangerous to the succeeding generation.

This disease which begins at hatching time and may continue to do damage throughout the life of the fowl, is one in which preventive measures must be used. The first principle in the prevention of this disease is the use of eggs for hatching which are free from infection, that is using eggs which come from flocks known to be free from this disease. The incubator makes this especially important because in this method of hatching, eggs from a considerable number of chickens are used, making the chance for the introduction of disease greater than when a fowl hatches her own eggs. It is therefore extremely important that hatching eggs be selected which come from flocks known to be free.

It seems wise to suspend hatching for a time on farms where the disease has gained a firm foothold. Such places should be disinfected. Incubators and brooders should be disinfected as a routine practice before beginning hatching operations. Cleanliness of all utensils and equipment should be practiced. Brooders must be kept clean and supplemented by disinfection. Chicks should be divided into as small groups as possible and raised on ground unfrequented by older chickens. The food and water supply must be protected against contamination.

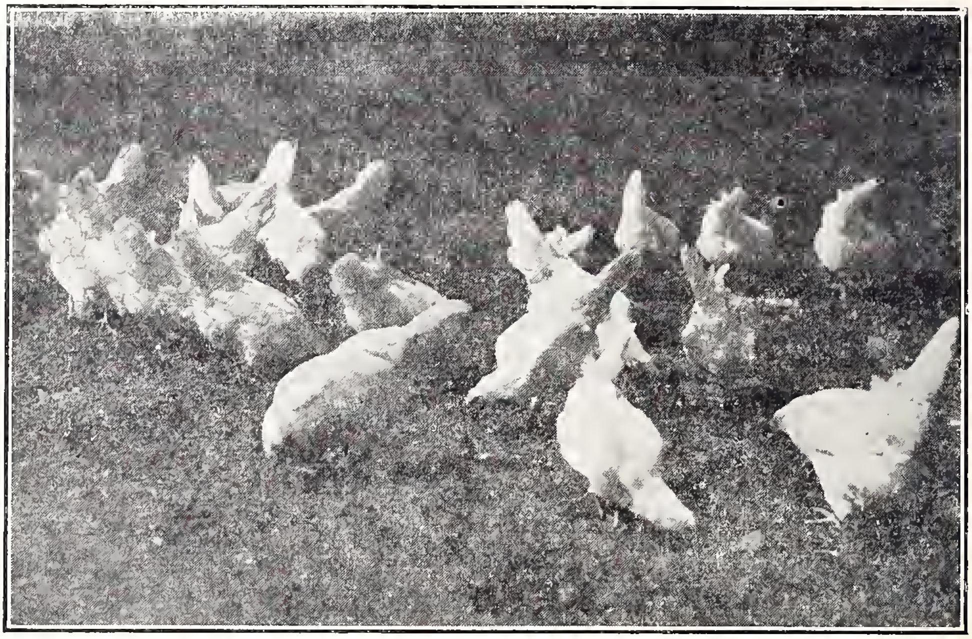

Fig. 2. **Healthy fowls raised free from bacillary white diarrhoea, tuberculosis and other diseases at the Pennsylvania Bureau of Animal Industry farm, Harrisburg.**

This disease also occurs in adult fowls usually in a chronic form, known as a carrier and is responsible for the infected eggs. No symptoms are noticed. Infection may destroy the function of the ovary or may not interfere with it. Some of the eggs laid by such a hen are infected. Not all eggs are infected and this may explain why some infected flocks may at certain times not have much difficulty with chicks. Infected fowls are usually poor producers. Quite often eggs from infected hens show poor fertility and poor hatchability. Investigators have shown that such carriers are responsible for the spread of white diarrhoea. Infected eggs are laid which hatch infected chicks and are responsible for outbreaks of white diarrhoea.

Method of Detection

The most practical method for the detection of this infection in fowls and for the control of this disease is the agglutination test. A blood sample is collected for the test. The test is based on the fact that when disease organisms are introduced into an animal body, there is produced a reaction by the body cells and body fluids. In this disease it is agglutinins which are produced and for which a search is made by the agglutination test. So when the particular bird which is being tested has been infected with the white diarrhoea organisms, its blood will contain the agglutinins which have the property of agglutinating the white diarrhoea organism under proper conditions. The serum from the blood sample is mixed in the proper dilution with a suspension of the organism, incubated and if agglutination follows the bird is a reactor. Such birds are then eliminated from the flock.

Repeated tests are necessary to rid a flock of infection especially when badly infected. It is more practical to dispose of badly infected flocks for slaughter and start anew with clean chicks.

The exact loss from bacillary white diarrhoea will never be known. The direct loss is very heavy. No one can estimate the indirect loss.

Baby chicks also die from many other causes. Many things may cause digestive disturbances and a diarrhoea. Among the causes of deaths in baby chicks are the following: overcrowding, overheating, chilling, improper ventilation, suffocation, lice, mites, filth, dampness, lack of sunlight, impure water, spoiled feed, inadequate diet, improper care, and other infections.

Since 1924 the Bureau of Animal Industry, Pennsylvania Department of Agriculture, has been interested cooperatively with the Bureau of Markets in a plan for flock improvement. This plan is based on flock culling and testing for bacillary white diarrhoea. The culling is under the supervision of the Bureau of Markets while the bacillary white diarrhoea work is under the supervision of the Bureau of Animal Industry. Testing for bacillary white diarrhoea has been done during the past three years in approximately 100 flocks comprising about 55,000 chickens. This work is done in cooperation with the local veterinarian.

Bacillary white diarrhoea work is also done for practicing veterinarians who are working with owners in ridding their flocks of bacillary white diarrhoea and who do not wish to sign up under the State flock improvement plan.

COCCIDIOSIS

Coccidiosis is a very fatal and very destructive disease of chickens especially of growing chicks. It is most fatal and occurs most often in chicks from three weeks to three months of age. This disease causes an enormous loss. Not only is it highly fatal but chicks which survive are halted in their growth and development and are more susceptible to later troubles. Older chicks and pullets may also become affected usually in a more chronic form and with less mortality but with important after effects. Coccidiosis is essentially a disease of the intestinal tract and is sometimes referred to as coccidial enteritis or bloody diarrhoea.

Cause of Coccidiosis

Coccidiosis is caused by a protozoan parasite called Eimeria or Coccidium avium. It is a round or oval shaped, single celled animal parasite which lives in the intestine. It reproduces by asexual as well as by sexual processes. Its development or reproduction takes place in the cells lining the intestine particularly in the ceca or blind pouches. In young chicks this parasite is found most often in the ceca. In older chickens it is found more often in the intestine. The oocyst or resistant stage is the form most often detected and from which a diagnosis is made. Such oocysts or egg stage forms must undergo sporulation under proper conditions of heat and moisture before other chicks become infected by drinking or eating material contaminated or soiled with the coccidia. The forms in the sporulated or infective stage reach the intestine by ingestion. The cyst wall softens and four small bodies or spores are released. These bodies gain entrance into the lining cells where reproduction begins by asexual and sexual methods. This reproduction takes place very rapidly and occurring as it does in the lining cells of the intestine, produces much cell destruction with bleeding and inflammation.

All birds may become affected with coccidiosis. It is most highly destructive to chicks usually after passing the brooder stage. Limited range seems to favor the development and it is very largely a disease of chicks raised under intensive conditions. Mature fowls seem to be fairly resistant although such birds may become grossly infected or they may become weakened by many causes, when the disease may become fatal. Anything operating to lower resistance makes birds of any age more susceptible and this is especially true during the growing period.

The mortality is high when young chicks are attacked. The onset is very rapid, chicks dying in bunches overnight. Mortality seems to be somewhat governed by the degree of the exposure as well as by lowered resistance. Once coccidiosis gains foothold, development is very fast and the disease spreads very rapidly through the flock. The premises become badly infected in a short time.

In young chicks the onset is rapid and the chicks show symptoms commonly associated with attacks of severe disease. Death occurs very quickly sometimes without showing any symptoms. Those which recover are stunted and poorly developed. Quite often leg weakness appears.

Coccidiosis in grown fowls assumes a more chronic course. There is a progressively increasing listlessness and loss of activity. Weakness, emaciation, leg-weakness and paralysis are frequently noticed.

Preventive Measures

Preventive measures are best in handling coccidiosis. The problem is one of keeping down mass infection. Affected birds should be destroyed. Ones not showing symptoms should be divided into as small groups as possible and removed to clean ground. Premises should be kept scrupulously clean and frequent dininfection practiced. Droppings should be removed often. Restricted rations should be fed. The control of coccidiosis depends first on keeping the young chicks in a robust healthy condition, and second in maintaining the premises in such a manner that large numbers of infective coccidia do not find their way into the intestines. For this reason quarters should be kept clean. Litter should be changed often, daily if possible, to remove the oocysts before sporulation occurs. Chicks should be kept in as small groups as possible to promote cleanliness and prevent mass infection.

The oocyst or egg stage is very resistant and may remain in the soil for one year or longer. It has also been shown that drying of oocysts inhibits sporulation, therefore dry quarters are essential and in a consideration of the soil the effect or drying and aerating the soil should be considered.

TUBERCULOSIS

Tuberculosis dates back to the time of long ago when men first began to live in compact social groups. Likewise poultry tuberculosis no doubt dates back to the time when fowl were first domesticated and kept in groups.

The great interest which is being given on all sides to tuberculosis makes avian tuberculosis a topic of prime importance to those interested in poultry. Tuberculosis has been reported in practically all kinds of birds and has been observed in all countries where poultry has been raised. It is most common in chickens and turkeys. Little is known of it in wild birds, but in wild birds kept in captivity, it is common.

Spread of Avian Tuberculosis

.When avian tuberculosis is found in a fowl it practically always has been introduced into that fowl from some other fowl either directly or indirectly. This introduction may follow the introduction of new birds to a flock. The trimmings and offal of tuberculous birds, as is found in garbage, may be a source of danger. Sparrows and pigeons are both known to be susceptible and from their habits of association with barnyard fowl, may be considered a source of danger.

It is believed that the intestinal tract is by far the most common means of exit for the tubercle bacilli, hence the most dangerous source of its spread. The intestinal lesions usually contain large numbers of bacilli. The feces often contain bacilli in great numbers.

The possibility of the escape of organisms from open lesions of joints, bones, conjunctiva, skin, etc., must not be forgotten. Experimental and clinical evidence strongly points out that avian tuberculosis is usually of alimentary origin. So it would seem the droppings of diseased birds contaminate the food and water, thus accounting for its spread. Bacilli introduced into the alimentary tract find portals of entry in the mucous membrane or lining membrane, either localizing in the intestinal wall or more frequently reach the blood capillaries and are carried to the liver.

The characteristic alteration in tuberculosis is a nodule. This tubercle degenerates with necrosis from the center outwards, giving rise to a cheesy granular mass. Very rarely is pus formation of calcareous material found, which is so common in mammalian tuberculosis. Three types of nodules may be recognized, the youngest tubercules in which caseation has not yet begun and which stand out sharply against the surrounding tissue; the older tubercles with beginning caseation and which show with less contrast. The larger nodules with considerable caseation. These nodules appear most often in the liver, then spleen and third, the intestines.

The disease has also been found but less frequently, in the lungs and kidneys also in the bones, joints, peritoneum, ovaries, gizzard, lymphnodes, conjunctiva, skin and heart.

Symptoms of Tuberculosis

Every variety of symptom shown in fowl may be presented. Only in advanced cases or where lesions are associated with organs, externally situated can it be recognized. Advanced cases commonly show extreme loss of flesh, dullness, roughness of feathers and paleness of the comb and wattles.

When handling affected birds their marked lightness is noted and owners of tuberculous birds will complain that their fowl are going light. "Going light" however, can be considered only as a symptom, because it is associated with other poultry diseases. When bones or joints are affected, the bird limps or drags one or both limbs and on close examination an enlargement may be found. A disease in which symptoms may be so vague and indefinite, obviously presents difficulties of diagnosis. Whenever it is a question of presence or absence of tuberculosis a definite diagnosis may be made by autopsies of affected fowl.

Treatment is of no practical value. Where it is desired to know the extent of infection throughout a flock, difficulties are presented, but we believe these may be overcome by the tuberculin test.

Control Measures

In controlling tuberculosis in poultry, it is likely most practical to kill the entire flock. Such a procedure should be done under official inspection and only carcasses fit for food permitted to be sold. Ground and quarters had best be idle for a time before restocking.

It is not believed that avian tuberculosis is so very prevalent in Pennsylvania. It is known to exist in some sections and in some cases flocks are badly infected with this disease. In 1922 the Bureau of Animal Industry, Pennsylvania Department of Agriculture, started some experimental work with avian tuberculosis. A study has been made of the tuberculin test in fowls as well as methods of control and eradication. Work has been done in seventeen flocks. One flock of 213 chickens was entirely negative. One flock of 168 chickens had 138 or 82 per cent reactors. The other flocks ranged between these two points in flock infection. It has required several tuberculin tests to make much headway in eradicating avian tuberculosis.

The use of the tuberculin test has controlled the spread and has in many cases aided in making unprofitable flocks get in much better condition. Work with the test has led to marked flock improvement in most cases.

From the work so far done it seems that avian tuberculosis may become a serious disease affecting poultry not only causing great losses by deaths, but also producing enormous economic losses. The nature of the disease makes it one which commands all the resources of the poultrymen and the veterinarian in combat. Its eradication from the farm flock requires careful, persistent and conscientious efforts. Its diagnosis is difficult by physical examination unless in parts externally situated or in advanced stages of the disease. Insidious in nature, it becomes firmly established in a flock before its presence is suspected. Serious inroads are made which cannot be halted except by tireless and continued efforts.

By the intradermal tuberculin test a diagnosis of tuberculosis can readily be established in the living bird and the extent of the infection throughout a flock can be determined. By the repeated use of the test, with the removal of reactors, careful cleaning and thorough disinfection of premises, tuberculosis can be eliminated from badly infected flocks. Quite a few badly diseased birds will not react to the tuberculin test and must be taken out by physical examination.

Correct breeding, proper feeding, careful management and practice of preventive measures against other fowl diseases are important factors in a consideration of avian tuberculosis. Premises should be kept clean and disinfection used to destroy infection.

Based on this work in Pennsylvania, the following plan has been devised to handle avian tuberculosis on a flock basis:

PLAN FOR HANDLING AVIAN TUBERCULOSIS

1. Determine the extent of the infection by history, tuberculin test and autopsy.
2. Removal and slaughter of diseased fowls, under official supervision. In extensively infected flocks the exposed fowls should also be slaughtered.
3. Clean thoroughly and disinfect premises under official supervision.
4. Flocks from which diseased fowls have been removed but where the entire flock has not been slaughtered, should be given a physical examination and all fowls in good condition tuberculin tested and should be retested in 60 to 90 days.
5. In the event of reactors being disclosed to the 60 to 90 day retest the flock should be again tested in 6 months.
6. After a negative test and all fowls are in good physical condition the flock should be tuberculin tested annually.
7. All diseased fowls should be killed under official supervision.
8. Droppings should be disposed of so as to not come in contact with poultry.
9. Cleanliness should be maintained and frequent disinfection used.
10. Fowls other than baby chicks should be tuberculin tested before being added.
11. Uncooked table scraps and similar refuse should be discontinued as feed.
12. Consistent effort should be made to exterminate carriers such as rats, mice and pigeons.
13. In the prevention and eradication of avian tuberculosis attention should be given the tuberculosis problem in all kinds of associated livestock especially swine tuberculosis.
14. Owners will be expected to practice careful breeding, correct feeding, proper flock management, principles of sanitation and to use preventive measures toward other fowl diseases.
15. The following certificate is issued to owners who will agree to follow the above plan and whose fowls have passed two annual negative tuberculin tests.

Agreement of Owner with the Bureau of Animal Industry, Pennsylvania Department of Agriculture.

I hereby agree to the terms of the above plan for the prevention, repression and eradication of avian tuberculosis. I further agree to observe and fulfill the foregoing requirements and failure on my part shall be sufficient cause for cancellation of this agreement.

My flock consists of ...., ...
Number Breed

Date ....192 Owner ....

Witness .... Address ....

Certificate of Inspection and Test for Avian Tuberculosis.

No. .... Issued 192

This is to certify that the entire flock of ....,
Owner

...., consisting of .... fowls, has
Address

undergone inspection; has passed the required number of tuberculin tests; and that the owner has complied with the requirements prescribed by the Pennsylvania Bureau of Animal Industry for the prevention, repression and eradication of avian tuberculosis.

This certificate is good for one (1) year from date unless revoked.

....192
Date

....
State Veterinarian.

Avian tuberculosis is also a danger to other farm livestock. It is considered more and more probable that avian tuberculosis may occur in a number of different animals. Tubercles in fowls usually contain large numbers of tubercle bacilli and these nodules are frequently found along the intestinal tract of fowls. This results in widespread dissemination of numbers of tubercle bacilli and because of the habits of farm-yard fowls, provides abundant sources of infection not only to fowls but to other farm livestock. The frequency of the avian type in species other than birds is not yet known and its incidence cannot be accurately estimated.

Avian tuberculosis is increasing especially in some sections of the country. Various investigators have shown quite conclusively that swine tuberculosis is quite often due to avian origin. The eradication of swine tuberculosis must include the eradication of avian tuberculosis.

The importance economically, the prevalence and the relation to other farm animals makes avian tuberculosis of great interest to all those connected with livestock. The fact that avian tuberculosis is not generally prevalent in Pennsylvania ought to challenge everyone to be alert and guard against its becoming widespread and disastrous to our flocks.

CHICKEN POX, ROUP AND CANKER

This group of diseases otherwise known as diseases of the head is very common, very important and causes untold trouble. Their differentiation is attended with considerable difficulty and much confusion.

Chicken-pox is a very common disease of poultry which does a great deal of damage and presents a real menace to the poultry industry. It is an infectious disease causing a systemic or general condition characterized by catarrhal and membranous exudates in the upper air passages and throat together with nodules on the unfeathered portions of the bird.

Roup is a catarrhal condition affecting the eyes and upper respiratory tract. It is usually caused by a lowered vitality due to exposure to draughts, poor ventilation and like errors in care.

Canker is a collection of cheesy material, an exudate on the mucuos membrane or lining membrane of the head and throat.

Chicken Pox Highly Tranmissible

Chicken pox, avian diphtheria or contagious epithelioma is a highly transmissible disease of fowls. It is readily transmitted by contact and can very easily be transmitted by inoculation. It is commonly accepted as being caused by a filtrable virus although some investigators question this. The cause of this disease is present in the nodules as well as in the cankerous areas occurring in the throat. It also is found in the blood in some stages.

Chicken pox or bird pox is especially prevalent in chickens and pigeons. It is found in all birds and none are known to be immune. The virus or cause of chicken pox easily transmits the disease by being introduced into the skin and in all probability abrasions of the skin and mucous or lining membranes are common modes of entrance. Biting insects are likely a factor in transmission. Infection by ingestion or eating materials containing the cause is also a method of transmission. This disease is readily transmitted by taking material from affected fowls and rubbing it into the skin or mucous membranes especially if the parts are scratched or scarified. The virus or cause is readily transmitted from chicken to chicken and pigeon to fowl but less readily so from fowl back to pigeon.

The disease may show a virulent form and cause death very quickly. In other cases the fowls show definite symptoms and in some cases may linger for weeks. All fowls do not die. In some cases a small percentage of the chickens become affected and very few die. In other cases practically all the birds become affected and with a high mortality or death rate. The disease is much more severe in the younger fowls and in many cases this is the only group which shows much loss. The disease is much worse during the Fall and Winter months and it is then that the losses are heaviest.

Chicken pox quite often begins as a cold. A discharge is present from the nostrils which becomes viscid and plugs the nostrils. The eye may also be affected. The larynx and trachea also become affected. Death most often occurs from the cheesy collections obstructing the respiration. In these cases before death the bird makes a peculiar noise in breathing. The mouth is opened widely and attempts are made to dislodge the exudate. Affected birds usually show the constitutional symptoms of dullness, inactivity, impaired appetite, ruffled feathers and later emaciation. The disease spreads rapidly through a flock affecting a large percentage of birds according to the virulence of the virus and the susceptibility of the birds.

For many years attempts have been made to immunize fowl against pox by vaccination. Immunizing agents or vaccinating materials have included mixed infection bacterins, vaccines, scabs and a vaccine prepared from the wart like growths which appear in this disease. Many reports are available which tend to show that such products are of value. No one has shown by carefully controlled experiments that any of these products are of value. The product most often used is made from the pox scabs. This material is dried and powdered. It is then suspended in normal or phenolized solution and injected.

During 1920 the Pennsylvania Bureau of Animal Industry conducted field experiments with this material in flocks under a variety of conditions. Flocks were selected in which the disease was just beginning, ones which were badly infected, ones showing a high mortality and ones showing a low mortality. From these experiments no value could be found in such a product either as a preventative or as a curative.

ROUP

Roup is a catarrhal inflammation of the eyes, nose or mouth, manifested by a discharge of a watery or viscid nature from those parts. Roup in fowl is in much the same category as cold in the human family. The lining membranes of the eye, nose and mouth are attacked and quite often complications of canker and other conditions follow. Weak birds and those of low resistance are the ones which suffer.

No specific cause is known for roup. Errors in care as draughts, undue exposure, uncleanliness and poor ventilation are the predisposing factors in this disease. Living, weather and feeding conditions play a very important part in this disease. The preponderance of certain bacterial species no doubt causes certain complications and special features to be presented.

The first sign of the appearance of this disease is a watery or sticky discharge from one or both nostrils. The birds sneeze or cough to dispel the discharge. The inflammation extends to the adjacent sinuses since the mucous does not readily drain away and there accumulates in those cavities a dry, cheesy mass.

Bad cases and weaklings should be destroyed. Affected birds should be removed. Premises should be cleaned up and disinfected. Faults in care must be corrected. The flock should have warm, dry, well ventilated quarters. Good care and good food must be given.

Various products have been used for treating roup as well as for vaccination. These products have usually been prepared from the various organisms isolated from cases of roup. The use of these products has not given uniform satisfaction and must be considered still in the experimental stage.

Ocular Roup is so named because it is a roupy condition of the eye. The eye in this disease first shows a watery discharge. The discharge soon becomes sticky or viscid and the eyelids stick together. Where the drainage is poor collections of cheesy material occur especially in the adjacent cavities or sinuses. This is particularly true when bacterial organisms are present. Examination of the discharge from such eyes very often shows the fowl cholera organism. This organism when injected into rabbits causes death from acute disease in a few hours showing the disease producing ability of the organism.

Nutritional Roup. This form of roup manifests itself as other kinds of roup, but is due entirely to a deficient ration which lacks proper nutrition. The fowls become listless and weak. A discharge appears from one or both nostrils and may occur in the face beneath the eyes. A film appears over the eye and cheesy material fills the eye. Cheesy formations also occur in the cleft of the palate and in other locations.

Post-mortem examination of the chicken shows the formation of yellowish white cheesy pustules in the mouth and throat. The kidneys are pale and there may be a deposit of white material on the surface of the internal organs.

Nutritional roup has been shown to be due to a deficient ration. The feeding of a large part of corn as the ration may produce this disease. The condition can readily be controlled by giving the birds all the green food they will eat.

Canker

Canker sometimes called avian diphtheria, is a collection of cheesy exudate on the mucous membrane of the mouth or throat. Canker is classified in three forms, chicken pox canker, mechanical canker and malignant canker.

Chicken pox canker is the one occurring most frequently and is the only one of any economic importance. It occurs as cheesy collections as mentioned under chicken pox.

Mechanical canker is produced by injury to the mucous membrane. It commonly occurs in the cleft of the hard palate. It yields readily tc treatment.

Malignant canker is so classified because it penetrates deeply into the tissues, does not respond to treatment, is accompanied by much depression, loss of appetite and emaciation, terminating fatally.

FOWL CHOLERA

Fowl cholera is a very important disease ot domesticated birds and occurs in an epidemic form. It is an acute disease with fever and is manifested by a general infection. In many outbreaks it causes a high mortality.

This disease is caused by an organism belonging to the hemorrhagic septicemia group and is quite generally known as the fowl cholera bacillus. It is a very small organism or germ, non-motile and shows a marked tendency to stain at the ends hence the name bipolar bacillus. It can readily be grown on artificial culture media but is never a very luxuriant grower. The colonies are small, discrete and fluorescent.

The organism causing this disease is more or less widely distributed in nature. It is highly fatal for fowls, particularly domesticated fowls and for waterfowl. Rabbits and mice are very susceptible and are most often used in the laboratory for diagnostic inoculation. Guinea pigs are not so susceptible.

The organism may remain alive in manure for long periods. It also remains alive in dead birds and resists low temperatures. When exposed to the air and drying with the action of sunlight the organism is quickly killed.

Fowl cholera infection gains entrance by means of the food and water. Such materials when contaminated with the organisms as contained in excreta, discharges or offal are frequent sources of the disease. The organism causing this disease may also gain entrance by means of the air passages and by abrasions of the skin. The blood of affected chickens contains large numbers of the fowl cholera organisms.

Natural infection usually results from the ingestion of saliva, droppings, excreta and discharges from affected fowls. Infected premises may also be responsible for this disease. It may also follow the addition of new fowls to a flock. As soon as the organisms gain entrance into the body rapid dissemination takes place. The organism swarms in the circulation.

Symptoms of Fowl Cholera

The symptoms vary as with any infectious disease. The disease usually runs a very rapid course. In the very acute form birds may drop dead without showing any symptoms. Usually however the birds become dull and drowsy. Quite often the first few birds die without showing any symptoms. A short time later the disease becomes an epidemic. In other outbreaks the losses are greatest in the first few days, when deaths stop or the outbreak assumes a chronic form. A chronic condition similar to roup may be the chief manifestation. Edema of the wattles may occur. In other cases there may be a chronic arthritis or inflammation of the joints with the formation of cheesy material.

The tissue changes found are those of septicemia. Bright red blood spots or hemorrhages may be found in various places. Fluid may be found in the tissues. The liver is usually swollen. In the more chronic forms the disease manifests itself in various parts of the body with small areas of a cheesy, dry yellowish substance which contains the organisms in large numbers. The symptoms are not sufficiently characteristic to make a diagnosis.

Fowl cholera may be met in many different forms. It may occur as a highly fatal rapidly disseminated disease or it may occur as sporadic cases and as chronic long drawn out cases.

How Outbreaks Occur

The typical outbreak of fowl cholera as we have found it in Pennsylvania occurs in the Fall or early Winter. It occurs more often in a flock of apparently healthy fowls in good production.

It is most serious in the commercial flock where great losses are sustained, but it also causes a considerable loss in some of our small farm flocks. We are usually told that the flock in good health and production suddenly loses a few fowls, then a few days later more losses occur. On questioning the caretaker they usually say that most of the birds die at first without showing any symptoms. Then a little later in the outbreak birds are noticed droopy, the feathers are ruffled, there is prostration, sometimes labored breathing with quite frequently a diarrhoea.

The disease occurs in a wide variety of ways and differs considerably in mortality as met in natural outbreaks. In some cases the disease is quite virulent and many losses occur right in the beginning of the outbreak. In other words the disease begins slowly but steadily causes greater and greater losses until a greater part of the flock is wiped out. In some cases fowl cholera disappears just as suddenly as it came and no further trouble occurs. Occasionally repeated outbreaks occur in the same flock. It is impossible to predict the outcome of an attack of fowl cholera in a flock since some outbreaks disappear readily while others continue and cause severe losses. Anything that has to do with a lowering of resistance is a factor in increasing losses from this disease.

Preventive Meaures and Control

Affected birds should be destroyed and healthy ones removed to non-infected premises. Cleanliness and disinfection is essential. The protein should be removed from the ration. More grain should be allowed. Fowls are naturally very fond of grain, it being their chief food in the wild state and we believe if they are fed such a ration in attacks of disease it raises their natural resistance.

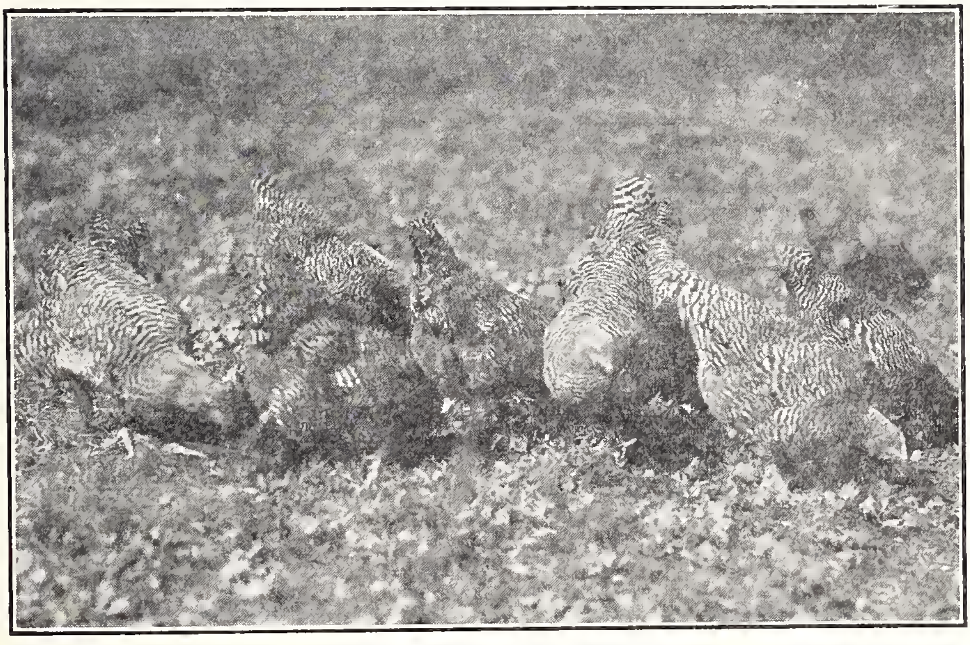

Fig. 3. Fowls on range at the Pennsylvania Bureau of Animal Industry farm, Harrisburg. Fowls are more healthy and more profitable when supplied with sunshine, range and green food.

Preventive measures are of greatest importance. Care should be exercised to not introduce the disease by means of new stock. New birds should be segregated for 30 days. Cleanliness is of prime importance and disinfection destroys and limits infection.

Feed and water should be protected against contamination and soiled premises should be avoided. Pigeons and other farmyard birds must be considered a menace in spreading this disease. Offal from table poultry should not be fed. Where outbreaks occur healthy fowls should be removed. Affected fowls should be destroyed and burned or buried deeply. The flock should be divided into as small groups as possible. Poultry houses, eating and drinking utensils and anything in contact with infected birds should be cleaned and disinfected. The protein in the ration should not be made too high. Liberal amounts of green food should be supplied. There seems to be quite a direct connection between high protein and concentrated feeding and losses from fowl cholera.

At this time there is no conclusive proof that any form of vaccination is advisable. Vaccines for fowl cholera are still very much in the experimental stage. Many products have been advised but so far as we are aware no carefully controlled and checked experiments have demonstrated their value. For the present all biologicals for use in fowl cholera must be considered in the experimental stage. Reliance must be placed on preventive measures and sanitation.

FOWL TYPHOID

Fowl Typhoid is an infectious disease of poultry caused by an organism belonging to the typhoid group. This disease has not been brought to our attention very much in Pennsylvania and we are inclined to believe it does not cause a very heavy loss in our state. This disease is more chronic in nature than fowl cholera.

Its differentiation from other infectious diseases requires laboratory examination with the recovery of the specific organism causing this disease.

FOWL PEST OR FOWL PLAGUE

Fowl pest or fowl plague is a very fatal disease of fowl and related species. This disease has invaded the poultry industry of the United States only once which was during 1924 and 1925. At that time quite an extensive outbreak occurred. This outbreak was entirely eliminated and no case of fowl pest has been reported in the United States since the Summer of 1925. As a menace to our poultry industry it is like the menace of foot and mouth disease to our cattle industry. It is much more fatal however than foot and mouth disease.

This disease seems first to have been described in Italy about 1878. It was found to be a disease different from fowl cholera, in Italy, in 1880, and Centanni and Savonuzzi in 1901 found that the cause was capable of passing through a porcelain filter. It raged severely in Northern Italy in 1894 and from there spread into the Tyrol and Germany, later into Belgium and France. It was spread broadcast over Germany in 1901 by the Brunswick Fowl Exposition and has often been called the Brunswick fowl disease.

Occurrence of Fowl Pest

Fowl pest first occurred in the United States in the Fall of 1924. Specimens of diseased fowl were brought to the Laboratory of the Pennsylvania Bureau of Animal Industry from natural outbreaks in 21 native flocks. In fifteen of these there were clear histories of the introduction of the disease by the addition of new fowl. The most of the cases occurred around Thanksgiving and Christmas time. Several of the outbreaks resulted from the purchase of a holiday fowl, either a chicken or turkey, on the poultry market. Such fowl were in contact with the flock for as short a time as an hour or a few days, with the consequent loss of large numbers and the entire flock in two cases.

The following is a typical example: The day before Thanksgiving, a man purchased two live turkeys at the Philadelphia poultry market. The turkeys were not killed for Thanksgiving. The morning after Thanksgiving one turkey was dead, the other one was sick and was killed. The following day one chicken died. From then on six or eight chickens were found dead each day until every one in the flock of 98 died. After about 70 of these chickens had died the owner called a practicing veterinarian, who brought dead fowl from this premise to the Laboratory. These fowl showed typical lesions of fowl pest.

All reported cases of fowl pest in Pennsylvania were investigated by the Pennsylvania Bureau of Animal Industry, the fowl quarantined and the premises disinfected before being released from quarantine. The infected fowl was considered the greatest source of danger in the spread of this disease. With the placing of embargoes, quarantines and restrictions on shipping poultry, together with the cessation of traffic in live fowl following the holiday season, there was a marked diminution in the cases of fowl pest. The vigorous measures instituted in the way of restriction on shipping and quarantine as well as the cleaning up and disinfecting of the poultry markets, no doubt had a very beneficial effect on the control of this disease, as well as other poultry diseases. It is very fortunate that this disease was recognized and measures instituted for its control, because it is perhaps the most fatal disease of fowl and, should it make inroads into our poultry flocks, would produce severe losses that would be felt not only by the producer but also by the consumer. The dangerous character of this disease warranted any radical measures taken for its control.

Description of Disease

Fowl pest is an acute, highly fatal disease of fowl and related species. It is caused by a filtrable virus, which means it is produced by an infective agent so far unrecognizable by present methods of research. This filtrable virus is so-called because it passes through the finest filters yet made and is invisible under the microscope with present methods of staining. It cannot be cultivated by present laboratory methods. Very small amounts of this virus, or materials which contain it, are highly infective. The virus is known to be present in the blood, in the nasal and oral secretions, in the intestinal and urinary excretions, in the mucous and serous exudates. It is present in the nervous system and probably in all tissues and tissue juices of the body. Filtrates of such materials even in high dilution also contain the virus. It is present in the organs and the injection of small quantities of emulsions reproduce the disease.

The virus is known to be in close association with the red blood corpuscles, very high dilutions of these, as high as one millionth of a cubic centimeter reproducing the disease. Blood cells are usually virulent while blood serum may be slightly or not at all virulent.

The virus like other viruses is easily killed. Exposure to direct sunlight or to a temperature of 70° C. for a few minutes, renders it inactive. Heating to 55° C. destroys it in one-half hour, 60° C. in five minutes and 65° C. immediately. Its activity is destroyed quickly by the common disinfectants. Dessication or drying is not rapidly fatal to it and under proper conditions it will retain its virulence for long periods.

Chickens and Turkeys Most Susceptible

Fowl pest attacks fowl and related species. Chickens and turkeys are most susceptible and most often found affected. Pigeons are quite resistant as are waterfowl, ducks and geese. Such fowl are infected with difficulty, even artificially, and are rarely found naturally affected. Mammals are immune. It is believed that this disease is not dangerous to man, since mammals are immune and there are no recorded cases in humans. With few exceptions, chickens can be infected with ease. A few seem to be immune. Chickens may be infected by subcutaneous, intravenous, intramuscular and intraperitoneal injection. Infection also succeeds when such materials are fed. Injuries to the skin, with introduction of the virus, or instillation into the eye produce the disease. After such infection the birds die in 36 to 72 hours as a rule and may or may not show symptoms.

It is a very acute disease and symptoms may not be noticed. When symptoms are observed dullness and inappetance appear first. The hens stop laying, the feathers are ruffled and the birds become weak and staggery. The course is quite rapid, chickens living only a few hours.

No satisfactory treatment is known. Prevention, control and eradication are the measures which must be used in handling this disease. Among the recommendations given during the outbreak in Pennsylvania were the following:

"Poultrymen should be warned against adding new fowl to their flocks. Where additions must be made the added fowl, regardless of the source, should be isolated for a period of at least one week. In any case all coops, containers and carriers should be cleaned and disinfected or burned. Measures must be taken then to destroy and limit the infection. Sick fowl should be destroyed and all carcasses must be immediately burned or properly buried. Frequent diligent cleaning of the infected premises, coops, crates, other containers and cars, followed by thorough disinfection is essential. The dangerous and common method of spreading the disease is the intermingling of fowl, exposure to infected premises, coops, crates, other containers and carriers."

INFECTIOUS BRONCHITIS

The name infectious bronchitis has been given to a disease in which bronchitis is the chief symptom. This disease has also been called chicken flu. It has been likened to the "shipping fever" of other livestock because it is most commonly found among fowls in transit and at feeding stations. Losses are usually heaviest among the younger birds although all ages become affected. The most prominent feature is a gasping for breath.

Attention has been called to this disease only in the last few years. It was especially prevalent in various places during the winter of 1924 and 1925 and at the time of the fowl pest epidemic.

Cause and Symptoms

The cause of this disease is not known. It is particularly prevalent at feeding stations and in conjunction with shipping. Without question exposure and undernourishment with malnutrition are very important factors in connection with this disease. Losses are much heavier in the birds that are in poor condition. Investigation into the cause of this disease has shown that chicken pox virus is present in some of these cases. Emulsions of material from the trachea of affected birds will produce chicken pox in some cases. Many attempts have been made at transmission of this disease with variable degrees of success. Swabing of the mouth and trachea of healthy birds with material from the trachea of dead birds is the most successful method of transmission. This method however is not uniform in results. No organism or germ has been grown from the blood or internal organs of affected birds which is thought to be responsible for this disease. Various organisms have been recovered from the trachea and throats of affected birds, the most prominent of which is the fowl cholera organism.

The gasping for breath is the most noticeable symptom. The head is extended upward and forward when the bird is gasping for breath and the intake of air is accompanied by a wheezing sound. Affected birds are usually found in a sitting position with a sleepy attitude.

The period of incubation is very short, and death or recovery follows very soon. In fowl which are successfully infected by artificial inoculation, symptoms and death occur in three to seven days.

This disease is not believed to be very prevaelnt in Pennsylvania. Very few cases have been found. The proper maintenance of a sanitary and satisfactory environment is the best method of control. Undue exposure and influences which lower resistance should be avoided. A careful program of feeding should be followed. Strict sanitary conditions should prevail. Affected birds should immediately be removed from the flock.

BLACKHEAD

Difficulties are frequently experienced when raising turkeys in the same manner as when raising fowls. This has led to the belief that the turkey by nature, is not well suited to the restrictions of domestication. Much evidence shows however that there is nothing in the nature of the turkey which unsuits it for domestication. Turkeys raised under domestic conditions become just as tame as any fowls.

The relation of disease to failures has been little studied and evidently many of the difficulties have been due to disease. The most prevalent and most dangerous disease of turkeys is Blackhead. It is a very fatal disease and most groups of turkeys which experience losses show Blackhead. Blackhead is so named because the head frequently takes on a bluish discoloration.

Blackhead in Turkeys

Young turkeys are very susceptible. The greatest losses occur during the first two or three months of life. Mortality is very high and in many cases all young turkeys die. The proportion of turkeys which become affected and the mortality varies with the age, becoming less with increasing age after three months.

The disease is spread principally by exposure to infected ground. Once the causative agent gains foothold trouble occurs year after year. Its ravages are usually much worse in sections where the land is low and wet. The disease is usually contracted by the young turkeys ranging on ground infected by droppings of carriers of the parasite causing this disease.

Turkeys only a few weeks old may die suddenly, without showing any symptoms. Usually affected ones are slower in their movements and do not keep up to the flock. They are found with the head drawn in. This disease is more prevalent during the late Summer and early Fall.

Much investigation has been done with this disease. At one time it was thought that the cecal worm was necessary for the transmission of Blackhead. It was believed that this worm injured the mucous membranes and made a portal of entry for the blackhead organisms. The disease has also been produced by the feeding of cecal worm eggs to young turkeys. However, the disease has been produced without the eggs or the worms and is known to be transmitted in other ways.

Prevention is difficult because turkeys range over such large areas. Young turkeys which range over infected ground usually become infected. Turkeys which are protected from infection do not contract Blackhead. This disease can readily be introduced by infected stock.

Added stock should be obtained from flocks which have had no trouble. At the first indication of infection, affected turkeys should be destroyed and premises cleaned and disinfected. Yards should be cultivated and limed.

Blackhead in Chickens

Blackhead has been considered comparatively rare in chickens. Young chickens have been found infected but the disease does not run through flocks of chickens as it does in flocks of turkeys. Blackhead has not been successfully transmitted by artificial methods as is the case in turkeys.

INTERNAL PARASITES

The internal parasites or endo-parasites are those parasites which inhabit or infest the internal parts or internal organs of their host. Internal parasites are usually present in the digestive tract but may also be present in the respiratory tract, blood and other tissues. The most important internal parasites of poultry are the roundworms and tapeworms.

Internal parasites are very prevalent among poultry and it is almost rare to perform a post-mortem examination on an ailing bird and not find internal parasites. These parasites are capable of inflicting considerable damage to fowl. The damage may be done in different ways. Large numbers produce a mechanical disturbance especially in the digestive tract and may interfere with the normal movement of the tract as well as interfere with the passages of food through the tract. Such parasites also absorb considerable nutriment. Internal parasites in many cases are believed to produce a toxin which is injurious to the host and produces its damaging effect by an interference with or a disturbance of nutrition.

Roundworms

The roundworms or nematodes are long, round, sometimes slender threadlike worms. The most common ones present in the domesticated fowl are ascaridia lineata the large roundworm, found in the intestine, and Heterakis papillosa, the small roundworm found in the ceca. Capillaria retusa a whipworm is commonly found in the intestine.

Ascaridia lineata is commonly known as the large roundworm of poultry. These worms are often present in sufficient numbers to occlude the lumen of the intestine. The eggs of this parasite are deposited in the intestine by the worm or on the exterior by its disintegration after death. Such eggs undergo a stage of development or growth which is known as embryonation. When such embryonated eggs are picked up by other birds with food and water, they hatch into a new worm and the life cycle is complete.

Ordinarily such eggs do not hatch until they are taken into the alimentary tract by another bird. The length of time these worm eggs will remain alive in droppings, and about premises has not been definitely determined but it is known that they are viable for one year.

Old birds are rarely heavily infested. Young birds are quite susceptible and when heavily infested become stunted in growth and show signs of general unthriftiness and emaciation.

Cecal Worm

Heterakis papillosa or the cecal worm is much smaller than the large roundworm. It is very commonly found in the ceca of chickens and it is believed that very little damage is produced by this parasite.

Capillaria retusa the whipworm is a small hair-like worm with a typical whip and is found embedded in the mucosa of the intestine. This worm is quite difficult to see without the aid of a microscope.

Spiroptera hamulosa is a small, coiled reddish white worm found embedded beneath the mucosa of the gizzard.

Gapeworm

Syngamus trachealis or gapeworm is a slender, reddish forked worm. It is found in the trachea and bronchi. The worms are expelled by coughing and the eggs distributed by disintegration of the worms. The eggs are elliptical, thin shelled and usually segmented. The water and soil become infested with the eggs which are picked up by the young chicks. Wet soil is favorable for their development.

The presence of these worms is indicated by the peculiar wheezing cough and gasping for air. The chicks are dull with ruffled feathers, inappetance and the gaping symptom. The young chicks are harmed most and a large mortality is frequently found.

Experimental work by the Federal Bureau of Animal Industry has shown that turkeys frequently harbor gapeworms without any damaging effect being produced. Young chicks are easily infested artificially as are turkeys by feeding. From this work it would seem that turkeys are an important factor in the spread of gapeworms.

The eggs of the gapeworm are scattered over the soil in the feces of the turkey. Later some of these eggs or larva that have hatched are picked up again by turkeys to increase the number or by chickens which show symptoms of gapes. Chicks young enough to become infested soon die and do not spread the infestation very much. Older chickens as a rule do not become infested and do not harbor the parasites long. Thus by keeping turkeys away from young chickens and providing the chicks with runs where there have been no runs for a year or two the danger of losses can be reduced.

Tapeworms

The poultry industry is suffering greatly from the ravages of tapeworm infestation. Tapeworm infestation is insidious and widespread. Tapeworms are becoming more and more prevalent and indeed few poultry farms do not suffer from this parasitic infestation. Tapeworms require an intermediate host for their development, and this fact adds to the complexity of their control. It is necessary not only to combat the mature worms, but also to control larval development in a form of animal life distant from the species which is attacked.

The effects of tapeworm infestation vary with the individual, the age of the fowl and the degree of infestation. In general light infestation may not be noticed, while moderate to heavy infestation, usually causes marked disturbance. The young growing birds suffer most and the greatest damage occurs during the summer, fall and early winter. Tapeworms result in a depraved appetite and a great desire for water.

Tapeworms are flat worms and the heads attach to the mucous membrane or lining membrane of the intestine by means of suckers. In addition to the suckers many have hooks by which they also attach. The segments and eggs pass out with the droppings to be picked up by the various intermediate hosts to develop and reinfest or to infest other fowls. Very little attention has been given the problem of intermediate hosts of tapeworms and many are unknown. There are several varieties of tapeworms, each with its own intermediate host and individual peculiarities. Some are very small, microscopic in size such as Devaine proglottina and some are large as Choanotaenia infundibuliformis which is sometimes 9 to 10 inches long. The intermediate host of Davainea proglottina is a snail and several species may be inhabited. The intermediate host of Choanotaenia infundibuliformis is the common house fly, musca domestica. For practical purposes the intermediate hosts may be said to be snails, insects, flies and small forms of life which fowl commonly eat. Tapeworms do the most damage to the young growing chickens and it has also been noticed that the young chickens are more active, range farther, chase flies more and eat more insects than do the older ones.

Davainae proglottina is one of the smallest tapeworms of fowl. It usually occurs in 2 to 5 segments. The terminal segment is often as long as the entire length of the other segments. The largest specimens are only about one-sixteenth inch long, and are easily overlooked unless the microscope is used. The head is small and behind it the segments are constricted to form a neck. The suckers are circular and small, each furnished with a single row of hooks. The chain is composed of 2 to 5 segments, the first of which is very small, those following becoming rapidly longer and broader. The intermediate hosts are three species of slugs, limax maximum, limax agrestis and limax flavus.

Davainea cesticillus is quite common in Pennsylvania. The head is globular. The first segments are short and much wider than the head. It is usually short in length and is found in the anterior portion of the intestinal tract.

Davainea tetragona is so named because the head is tetragonal in shape. Its short neck is followed by trapezoid segments, those terminal, being longer than is the width. Snails are believed to be the intermediate host.

Davainea echinobothrida somewhat resembles the former one. This tapeworm results in the condition known as nodular taeniasis. It attaches to the mucous membrane or lining membrane where a nodule forms. The nodules may be confused with tuberculosis. The finding of the tapeworms with the nodule differentiates it.

Hymenolepis carioca is thread like and may occur in great numbers. It is very fragile. Choanotaenia infundibuliformis is a large tapeworm. It may be three-fourths to 10 inches in length. The head is small and globular or conical. The neck is short as are the first segments, those following showing the anterior border, narrower than the posterior funnel shaped, hence the name, infundibuliformis. The larval form of this tapeworm occurs in flies. Feeding such flies produces the tapeworms in other chickens.

Control Measures

The problem of the control of this parasitism involves the destruction of the parasites, the prevention of infestation, proper flock management with careful sanitation especially as regards the soil. The ideal method of preventing infestation is prohibiting the access of fowl to any insect life which may be the intermediate hosts of tapeworms. This may demand insect proof and fly proof quarters.

The droppings should be handled so that the eggs are killed and so that insects cannot feed upon them. Droppings should be collected often and should be destroyed or placed in containers which are fly proof and insect proof. Lime or ashes should be mixed with the droppings to destroy the eggs and prevent them being picked up or serve as insect breeding places. Premises must be kept clean and sanitary. Wire should be placed beneath the roosts to prevent chickens coming in contact with their droppings. Water receptacles should be kept clean and so placed as to not be contaminated with droppings.

Flies and insects should be kept down to a minimum and their breeding places destroyed.

In controlling parasites chickens should not be kept on the same ground year after year. Chicks should be brooded on clean ground and kept away from places frequented by the older chickens. Open, porous, sandy soil with a gravelly subsoil is best. Heavy shale or clay soil should be avoided because such soils are wet and cold. A wet soil favors parasites and too much dampness and moisture is not good for fowl.

The successful prevention and control of poultry parasites depends on the use of foundation stock free from these conditions, raised on clean premises without exposure. Prevention is the most practical and most satisfactory method of control.

EXTERNAL PARASITES

External or ecto-parasites which live on the external or outer surface of the body also are a serious problem confronting the poultry keeper. Fowl may be continuously annoyed by the irritation and disturbance produced by biting or burrowing parasites. Such fowl may be devitalized by the loss of blood and are not capable of high production. Young or weak individuals may die while others are rendered more susceptible to devitalizing influences and to infectious disease. External parasites may also be a factor in the transmission of diseases.

The propagation and existence of external parasites depends on many conditions. Crowded and dirty houses favor the propagation and spread of parasites in poultry. Lice and scab mites thus find their most favorable season during the winter, when their transmission is facilitated and the reduced activities of the skin offers less resistance to invasion. Flies, fleas and ticks are more prevalent in the summer.

Lice

The lice attacking birds are biting lice. Blood sucking lice are not parasitic upon birds. Lice are without wings. Their mouth parts are for biting. Lice have three pairs of legs and the body is distinctly divided into head, thorax and abdomen. Lice usually permanently infest poultry quarters. They feed on the epidermal products as the feathers, scales and skin. By means of claws and mouth parts, injury with pruritis is caused. Excessive infestation hinders normal growth and development. Brood hens may be so annoyed as to interfere with incubation. Chicks hatched by hens are much more subject to lice than those hatched in incubators. The reason for this is quite obvious since most hens have a few lice and chicks are quite susceptible to lice when exposed. The lice find a favorable habitat on the body of chicks.

The most common hen louse is about one-sixteenth inch in length and of a pale straw color. It moves very rapidly among the feathers of the fowl. The louse appears to live on most parts of the fowls body and has been found most numerous about the vent. The lice subsist on bits of feathers and scales of skin. Irritation begins which eventually weakens the fowl and gives opportunity for various diseases to develop. This is especially true of chicks. When lice are abundant the chickens growth stops, diarrhoea is present and a weakened condition results. This keeps the chicks from making normal growth. In mature fowl, the production falls off and the fowl becomes unthrifty.

The eggs called "nits" are pasted on the feathers, usually near the base of the feather shaft. The eggs are most often seen on the feathers around the vent. The eggs hatch in from five to seven days and mature in about two weeks. By this rapid multiplication the numbers ofttimes are abundant. The lice are most often found under the wings, on the head when they are known as head lice and especially around the vent in older fowl.

In the control of lice and other external parasites, the dust bath is of especial importance. The dust should be light, dry and fine. Sandy loam or road dust is suitable. Equal parts of loam, sand and sifted coal ashes make a good dust bath. Dry earth is also good. The dusting box should contain at least six inches of the dusting material.

Mites

All poultry keepers are aware of the damages produced in poultry by mites. Many different kinds of mites are quite prevalent wherever poultry are kept. The ones producing the greatest damage are red mites and mange mites.

Red Mites. These parasites differ from lice in that they do not live on the fowl all of the time. Red mites attack the fowl at night when they swarm over the fowl. These are blood sucking parasites and during the night engorge with blood. This causes much irritation as well as causing loss of rest and sleep. These parasites in heavy infestations may cause sitting hens to leave their nests. In the morning they leave their host to hide in cracks and crevices of the perches, nest boxes, walls and about the premises.

Red mites live from the blood which is derived from their host. Such mites may exist for a long time without any food at all and have been kept alive for three months without nourishment. It is believed they can exist in an unoccupied poultry house throughout at least a single season.

Red mites when present in large numbers cause much damage. They are scarcely visible to the naked eye, but when collected can easily be seen. They are seen beneath the roosts and in cracks and crevices. They are more easily seen when engorged with blood.

The eggs are laid in sheltered places as cracks and crevices and hatch in a few days. The larvae attack the host immediately and after engorging and molting mature in about one week. Red mites cause much irritation. Fowls are annoyed and are damaged by loss of blood. Infestation when severe produces emaciation, weakness and death. Decreased production is marked. Young chicks may become infested. Red mites may attack man and other animals but usually do not live long on any host except the fowl.

Red mites are quite hard to overcome since quite often the quarters become infested badly before it is known, owing to the fact that these mites are not found on the fowl in the daytime. If the house is old it is sometimes justifiable to burn it. Thorough cleaning is the first measure to be employed. The perches and nests should be torn out for thorough cleaning. The walls, ceiling and floor should then be cleaned by sweeping and if water under pressure is obtainable, the house should be thoroughly washed out.

In planning houses for poultry care should be exercised to construct houses which can be cleaned and which have a minimum of places where vermin may collect. Perches, nests and similar fittings should not be permanent but arranged so that removal is easy for purposes of cleaning and disinfecting. Because of the danger of mites and lice of fowl getting on man and farm animals, the poultry houses should not be located in close proximity to other farm buildings. Houses should be constructed with plenty of light because this facilitates cleanliness and also is detrimental for the propagation of mites.

Scaly Leg. Scaly leg is a condition in the fowl which is very prevalent and is caused by a mite. The name of this mite is Cneimidocoptes mutans, which is microscopic in size. It usually localizes on the legs and produces a condition of encrustation which causes the name scaly leg. The microscopic mite burrows into the epiderm causing severe irritation with exudation. The exudate dries forming scales or crusts which are very adherent and irregular in shape. When such crusts are removed quite often an irritating and sometimes bleeding skin is present. The mites are found by microscopic examination specially in the deeper layers of the skin.

The course of the disease is slow, extending over many months, the legs becoming very much deformed and of large size due to the encrustations. Advanced cases quite often show lameness and disease of the joints may arise. Loss of appetite, dullness and progressive emaciation may be present.

The Depluming Mite. This mite infests the portion of the quill beneath the skin and causes the loss of the feathers hence the name depluming mange. It is due to the mite Cnemidocoptes (Sarcoptes) laevis. Feather pulling at times is due to this parasite which causes irritation and the bird pulls the feather. It usually causes a "patchy" condition affecting certain localized regions. These areas, in some cases, are located on the back, in others are chiefly on the neck producing a condition of bare-neck. Sometimes the quills break off leaving stumps which are surrounded by epidermal scales. Severe infestations cause irritation, unthriftiness and later emaciation. The course is slow. This parasite is introduced by infested birds.

Fleas

Fleas attack fowl causing considerable annoyance because they are blood suckers. The Pulex gallinae is the common bird flea. It is provided with piercing mouth parts by which it can penetrate the skin and suck the blood. Fleas are found about unsanitary poultry premises and about the nests. They occur on "sitting" hens and are temporary parasites usually feeding at night and hiding by day. The eggs of this parasite are laid in filth in cracks and crevices. The nits hatch in a week or ten days into white larvae which after a short time spins a cocoon and in about 3 weeks becomes an adult flea. Occasionally fowl are attacked by fleas of the cat and dog.

Flies

While flies are not known to attack fowl to any great extent they do help to make a premise unsanitary and produce filth as well as being the hosts for some species of tapeworms. Places where flies can breed should not be tolerated about a poultry house and all filth should be destroyed.

Mosquitoes

Mosquitoes are sometimes found in large numbers about poultry quarters. No doubt they cause considerable annoyance and their breeding places should be destroyed.

Bed Bugs

Bed bugs have been known to attack fowl and cause considerable annoyance as well as in some cases causing death. Bed bugs attack fowl at night when the blood is sucked. Hiding places are found in cracks and crevices about the poultry quarters.

Favus

Favus is caused by a fungi which attacks the skin usually of the head. It is a chronic disease manifested by the formation of white areas. The infection is readily transmitted from fowl to fowl by inoculating the comb from diseased fowl. Usually after natural infection the first change is on the beak and occurs as small white points. The crusts spread and the small patches go together. When it affects the skin where there are feathers the whitish crusts accumulate at the base of each feather. Some of the feathers fall out and bring the whitish crusts as a collar. The disease causes very little disturbance. Recovery may occur or the disease may persist for years. Great care should be taken to get out all infested birds from flocks, otherwise slight cases will perpetuate the disease. Care should be exercised to prevent the introduction of birds from infected flocks.

ASPERGILLOSIS

Aspergillosis or brooder pneumonia is caused by the fungus, aspergillus fumigatus which attacks the lungs of chicks. In earlier times brooding facilities were not good and with little attention being given ventilation and cleanliness, this disease brooder pneumonia was quite prevalent. Better methods of brooding with cleanliness have made this disease rare. The fungi aspergillus fumigatus is widely distributed in nature especially among damp vegetable matter. It is therefore prevalent in damp quarters and among mouldy feed or litter. Birds which inhale the spores furnish a favorable place for its growth.

It attacks all kinds of birds but mostly those under domestication and in crowded quarters. Cage birds are also often affected. The disease may be transmitted by inoculation or inhalation of the fungus. After inhalation changes are usually confined to the respiratory organs. Losses may be quite high in young chicks. Older ones are quite resistant. In the older birds this disease is more likely to occur sporadically while in baby chicks losses are severe and of an acute nature.

Leukemia

Leukemia is a disease of the blood and blood-forming organs. It is characterized by enlargement of the liver, spleen and kidneys. In some cases the liver becomes enormously enlarged and usually is the organ which shows the greatest change. Many attempts have been made to isolate an organism from the blood and parenchymatous organs but without success. Some investigators have reported successful attempts in transmitting leukemia in fowl by intravenous and intra-peritoneal injection of cell free filtrate which points to an ultra-microscopic virus as the causative agent. The disease has been transmitted by emulsions of organs. The disease is most often seen in chickens.

Death may result quickly or the disease may assume a chronic form. Recovery has been observed. Chickens may die without showing any symptoms. In other cases there is observed a progressive emaciation with dullness and weakness. There may be a diarrhoea. The comb and wattles frequently become pale as a result of the increase of white cells with a decrease in the number of red cells. The blood is thin, fails to clot readily and is a pale red color. The blood is found to contain a greatly increased proportion of leucocytes to red blood cells.

The enlarged liver, spleen and kidneys are found engorged with leucocytes. The round cells fill the smaller capillaries and occupy a peri-vascular position. There is also a hyperplasia of the cells of the bone marrow and spleen. This is where the proliferating cells originate which infiltrate the liver and kidneys.

Botulism

This condition is not frequently found in fowl. It does occur and at times produces marked and distincitve symptoms. The condition is most typical when it appears in an acute form. In such form it occurs very suddenly and the fowl die or recover in a very short time. In other cases a chronic condition occurs with weakness and sometimes a staggering gait. Botulism occurs most often in the summer and fall. Acute outbreaks frequently cause severe losses. The disease is due to the toxin of clostridium botulinus as found in decaying animal and vegetable matter. Maggots which feed on material containing the toxin are also responsible for this condition. Chickens dead of botulism frequently show maggots in the crop. The organism responsible for the formation of this toxin is clostridium botulinus an anaerobe. It is found quite prevalent in nature. It is the same organism which causes the formation of the toxin responsible for ripe olive poisoning in man.

Botulism appears most characteristically when it occurs very suddenly. A large number of the flock is found affected shortly after the flock has been known to be all right. Extreme prostration may be the most pronounced symptom. Often it is impossible to differentiate the living from the dead birds, the prostration is so complete. Birds may be found sitting or lying, with the head on the ground and eyes closed. Considerable mucous may be on the beak, so that soil, dirt and dust stick to the beak. The comb and wattles are bright red and eggs may be laid even in this prostrate condition. If the bird is aroused it may not be able to raise its head or it may be unsteady and partly open the eyes. If made to move, birds may take a few steps in a crouching position, usually going down shortly. The head can hardly be raised, hence the name limberneck. In some cases the feathers are very easily pulled from the body. Death or recovery occurs very soon.

TUMORS

Tumors have generally been considered not to have a very important place in poultry pathology. Their presence has not been known to be numerous and has not been considered a serious problem. However tumors of fowl are being found quite often and seem to be coming more and more common. Tumors are usually more often found in old animals. The fact that chickens are short lived makes their presence less important. Their frequency however indicates that they probably develop quite rapidly and we believe should be given greater consideration.

Both solid or firm tumors and soft or cystic tumors are found in chickens. The solid ones are most common.

Tumors are most often found in the internal organs resulting in enlargement of the liver, spleen and sometimes other organs. Death sometimes results from internal hemorrhage originating in the tumor, the underlying tissue or the enlarged liver or spleen. Females with highly taxed generative organs show a tendency to tumor formation of the ovary.

Tumors of the small round celled sarcoma type are most prevalent in the poultry tumors studied in Pennsylvania.